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ELECTRIC TRACTION.

Electric Traction. By Prof. Ernest Wilson and Francis Lydall. Two vols. Vol. i., Direct Current, pp. vii+475; vol. ii., Alternating Current, pp. vii+328. (London: Edward Arnold, 1907.) Price 15s. net each.

THERE is no announcement on the title-page that this work is a second edition of a book which appeared in 1897. This omission, however, is fully justified, for although technically the present work may be considered a new edition, it is in reality a new work. Progress during the last ten years has been so great that to bring the work up to date it had practically to be re-written and very greatly enlarged. Even in its present form of two handsome volumes, comprising together some 760 pages, the authors have not treated the subject exhaustively. This statement is not meant as a reproach, but simply as an illustration of the fact that the application of electric traction to tramways and railways has become so many-sided that an exhaustive treatise of the subject can hardly be expected. All that can be expected is that the authors should make a judicious selection of types and systems, and this expectation is on the whole fulfilled in the present work.

There is, however, one rather important omission, namely, the use of the three-wire system on direct-current railways, as suggested by Krizik and carried out by his firm on the Tabor-Bechyne line in Bohemia. It is true that the authors give on p. 416 a sketch of the circuits and a short description of the system adopted on the City and South London line, which is a three-wire system in the sense that the trains in one direction are worked from a positive 500-volt trolley and the trains in the other direction from a negative 500-volt trolley, but this is a far less advantageous system than that devised by Krizik, where the positive and negative side of the three-wire system are utilised in the same train, and the earth or rail return is only called into requisition in the event of a breakdown on one side of the system.

Of the two volumes the first is devoted to direct-current and the second to alternating-current railways. The treatment is mainly descriptive, without much criticism on the authors' part, and on the whole there is a tendency to give prominence to American designs or to English designs of American origin. This favouring of American work goes so far that the authors, whilst referring to standardisation of tramway motors as determined by the American Institute of Electrical Engineers, completely ignore the standard rating adopted by the International Association at the Milan Congress last year. Possibly they may think the American standard better, but that is no reason why they should keep their English readers in ignorance of the fact that there is a standard in use on the Continent of Europe which will have to be complied with by those firms who secure contracts on the Continent.

A little more than half of the first volume is given up to tramway work, and deals in succession with the motor, the controller, resistances, trolleys and bows, rolling stock including brakes, the track, overhead equipment, slot and contact systems, feeders, generating stations, car sheds, storage-battery traction and regenerative control. Approximately the same order in the treatment of details is followed in the part devoted to railways, with the addition of a chapter on substations. Then follows a chapter on cost of tramway work, which, being taken from actual practice, should prove very useful when getting out preliminary estimates, also a chapter on working expenses, traffic receipts and tramway accounts in general, and finally there is an appendix giving all the Board of Trade regulations.

As already remarked, the treatment is mostly descriptive, but not always complete. Thus the suspension of tramway motors is dealt with in only four lines on p. 78, and in the description of magnetic brakes we miss the magnetic friction brake on the axle, although magnetic track brakes are not only well described but also critically compared. The tables relating to turn-out, cross-over and transition curves on pp. 112 to 116 are well arranged, and will be found very useful in laying out the track. Also the details of overhead equipment are well represented, but we miss the bridge wire round the ears which has of late years been introduced as a precaution to avoid the trolley wire coming down in the event of its breaking, which, as is well known, takes place generally close to the ear.

As regards buffer batteries, the authors seem to be under the impression that Mr. Highfield made their use possible by his automatic reversible booster. This is not so. Buffer batteries have first been suggested by Dr. Edward Hopkinson in 1893 in a paper read before the Institute of Civil Engineers on the City and South London Railway, and very shortly after, the first buffer battery was installed by the Tudor Accumulator Co. in the power house of the Zurich tramways, the economic success being so remarkable that buffer batteries had become a quite regular feature in tramway power houses on the Continent long before Mr. Highfield designed his very ingenious system of boosting.

On p. 197 the authors show a diagram (Fig. 144) and call it a negative booster wrongly connected. In this case the booster is supposed to be a series machine driven at a constant speed. There is nothing wrong about its connection; the only wrong thing in the diagram is the direction of the current as marked by arrows. A moment's consideration will show that if the machine is run at the critical speed in relation to the resistance of the return feeder, it is the very best possible negative booster, since it will relieve the rails from return current to even a greater extent than the booster with excitation from the positive feeder.

The authors' treatment of the complicated subject of controllers is excellent. They always give first a diagram showing the principle and then the actual arrangement of circuits and contacts, thus rendering the study of an intricate subject comparatively easy. The same praise may be given to their way of working out running diagrams and the determination of the

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best acceleration. They show that although high acceleration means low energy per ton-mile, it does not necessarily mean low running cost, because the cost of substations and feeders increases considerably with the acceleration provided for. All these matters are treated from a thoroughly practical point of view.

The second volume begins with a chapter on the theory and design of the polyphase railway motor, with useful examples of such motors as applied to the Valtellina and other lines; then follows control, overhead equipment, rolling stock, energy consumption, and other details. In view of the increasing importance of single-phase working, the authors have done well to restrict the three-phase part of the book and to devote the space saved to the more recent single-phase system. Here they break new ground by going at some length into the question of single-phase commutator motors, both with and without commutating poles, compensating winding, and other refinements. There is, however, a certain ambiguity about the motors described, and the reader will not find it easy to know what particular type is meant, especially as diagrams of windings and vector diagrams are too sparingly used. Neither will he find mention of the designers by the names of which particular motor types have become known; there is no mention of Lamme, Fynn, Winter-Eichberg, Richter, Latour, and so on, yet each of these men have produced distinct types. To give an instance of the ambiguity: we are told that the London Bridge to Victoria line is being equipped with "compensated repulsion motors," but nothing is said of the particular type being the Winter-Eichberg.

The chapter on overhead work is distinctly good, both as a theoretical treatise and as a collection of examples from the best modern practice, whilst the chapters on feeders, inductive drop in rails, energy consumption, and capital outlay on single-phase railways will repay careful study on the part of the engineer who has work of this kind to design.

Gisbert Kapp.

VETERINARY ANATOMY.

The Surgical Anatomy of the Horse. Part ii. By John T. Share-Jones. Pp. xii+190. (London: Williams and Norgate, 1907.)

Why do British veterinary anatomists adhere so tenaciously to a nomenclature which is absolutely indefensible? Many of the terms at present employed in the various English text-books on the anatomy of the domestic animals are admittedly unsatisfactory; yet British veterinary writers persist in their use, with the result that a Continental reader wishing to consult an English work is put to an infinity of profitless trouble. Not only are the English names incompatible with comparative anatomy; sometimes they are strikingly absurd. No more deplorable instance of misdirected ingenuity is to be found than in the names given to the three phalanges. The first phalanx rejoices in the name of "*os suffraginis.*" Not only is this an unknown expression in scientific anatomy, it is also the outcome of error. Its inventor—possibly a French writer, be it said—completely mistook the meaning of the Latin word *suffrāgo* (*suffragīnis*), which is generally defined as "the ham or hough of a quadruped's hind leg," and is used by Pliny and others as opposed to *armus*. If, then, an *os suffraginis* is to be recognised, it seems more reasonable to regard it as the femur. It certainly is not the first phalanx.

The second phalanx is known to the quasi-scientific veterinarian as the *os coronae*, a term which may be passed over by saying that the only defence for its use is the application by the stable-man of the name *coronet* to the region of the limb in which the bone is situated. To speak of the third phalanx as the *os pedis* is to subvert the meaning of the word *pes* as used in anatomy. The *pes* of the scientific anatomist includes the tarsal, metatarsal, and phalangeal regions of the posterior or pelvic limb; and has its parallel in the *manus* of the anterior or thoracic member.

In no part of the body are objectionable terms applied so frequently as in the limbs. This is doubtless due to the extreme degree of modification from the mammalian type which has been produced during the evolution of the modern horse, a modification so marked as to lead the original inventors of veterinary anatomical nomenclature to devise terms which to them seemed fitting, irrespective of their incompatibility with anatomical terminology in general. The time has come, however, when there is little excuse for aberrations. The BNA was devised with the intention that it should make the writings of an anatomist easily intelligible to his brother men of science. Works on anatomy, whether they be purely anatomical or partly surgical, should embody the universal nomenclature. If thought necessary, as is doubtless the case in books written largely for the practitioner, the customary English equivalents might be set down side by side with their Latin synonyms.

Mr. Share-Jones, in the volume before us, employs exclusively the undesirable names found in other English text-books, with the result that he cannot expect to appeal to a wider circle of readers than those who speak the English tongue. What exactly the aim of Mr. Share-Jones may be is difficult to determine. He certainly cannot claim to have produced a surgical *anatomy*, since he deals at some length with fractures and other traumatisms, diseases, symptoms, and even treatment. How far he was justified in including such subjects as "sore-shins," "breakdown," "speedy-cutting," &c., in a work entitled "The Surgical Anatomy of the Horse" is doubtful; but it is beyond question that microscopic structure is out of place in such a production.

Reputable books on anatomy—surgical or otherwise—are now produced with illustrations which may be termed artistic without doing violence to the English language. Indeed, the illustration of scientific works in general is now an art in itself. This being so, a work the value of which depends mainly upon its plates is apt to be judged by a fairly high standard. Most of Mr. Share-Jones's figures would not stand such a judgment. Apart from their execution, it is difficult to see why some of them are printed on so large a scale as to require quarto plates. It is, further,

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